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SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: Prohus Hafer Examiner# : _____ Date: 4-16-02
 Art Unit: 2100 Phone Number: 30 Serial Number: 101020425
 Mail Box and Bldg/Room Location: _____ Results Format Preferred (circle): Paper Disk E-mail

If more than one search is submitted, please prioritize searches in order of need.

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc., if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: _____

Inventors (please provide full names): _____

Earliest Priority Filing Date: _____

For Sequence Searches Only Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.

5,761,301

1,420,427

10/020,425
020, 427
017, 965
017, 973

STAFF USE ONLY

Searcher: S Green
 Searcher Phone: 6-4767
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 Date Searcher Picked Up: 4-17-02
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 Searcher Prep & Review Time: _____
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Type of search

NA Sequence (#) _____
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 Patent Family _____
 Other _____

Vendors and cost where applicable

STN _____ ✓ 50.41
 Dialog _____ ✓ 26.41
 Questel/Orbit _____
 Dr. Link _____
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 Other (specify) _____

1 OF 1 DOCUMENT

5,761,301

GET 1st DRAWING SHEET OF 43

Jun. 2, 1998

Mark forming apparatus, method of forming laser mark on
optical disk, reproducing apparatus, optical disk and method
of producing optical disk

REISSUE:

Reissue Application filed Dec. 7, 2001 (O.G. Apr. 9, 2002) Ex. Gp.: 3642; Re.
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S.N. 09/588,364

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PRIM-EXMR:

Cain, David C.

LEGAL-REP:
Ratner & Prestia

SUM:

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a marking forming apparatus, a method of forming a laser marking to an optical disk, a reproduction apparatus, an optical disk, and a method of manufacturing an optical disk, which may be utilized, for example, to prevent duplication of optical disks.

2. Description of the Prior Art

With increasing use of ROM-type optical disks in recent years, pirated disks have also been spreading, infringing the rights of copyright owners.

This is because ROM disk manufacturing apparatus have been made readily available and also have become easy to operate.

A pirate can make a CD master disk just by extracting logic data from software contained on a CD, copying it onto a magnetic tape, and setting the tape on a mastering apparatus. Hundreds of thousands of pirated disks can be pressed from this single master disk. Since pirates do not, pay royalties, they make a profit by selling pirated disks at a low price. This necessarily means a financial loss to the copyright owner.

According to the current CD specification, only the function of reading logic data from a CD is provided, but no functions are provided to detect physical features of a disk. As a result, a pirated CD can be easily produced by bit-copying the logic data.

The prior art discloses a method of preventing piracy by adding a function to recognize disk physical features.

This method involves establishing a new specification that defines the inclusion of a physical mark on a master disk to prevent the pirating of disks made to this specification. As an example of the prior art, a piracy prevention method is known such as the one disclosed in Japanese Patent Unexamined Publication No. 5-325193. According to that method, in the cutting process the recording beam is deliberately swept in the tracking direction, when recording a designated region, to form a wobbling on the master disk. When the disk is played back on a reproduction apparatus equipped with a wobbling detection circuit, the disk is checked to see whether the wobbling is formed in the designated region. If it is detected that the wobbling of a designated wobbling frequency is formed in the designated region, the disk is judged to be a legitimate disk; otherwise, the disk is judged to be a pirated disk.

More specifically, based on predefined physical mark design data, a physical

mark is formed on the master disk by using a special mastering apparatus equipped with a wobbling function. This prevents pirates from making pirated disks since they do not have such special mastering apparatus nor physical mark design data. Such an anti-piracy mark needs to be formed on every disk made to this specification. However, since it is possible to extract this physical mark by examining a legitimate disk, the prior art method has had the problem that pirated disks may be made if such a special mastering apparatus falls into the hands of an illegal person. In this patent specification, piracy prevention methods of the type that forms a physical mark on the master disk will be referred to as master disk level methods.

Besides the above-described method, there has been proposed a more sophisticated master disk level method which involves forming a more complicated physical mark. On the other hand, a replica method is known that makes a replica having exactly the same physical features by melting the resin of a legitimate disk no matter how complicated the physical mark is made at the master disk level. This method requires much time and cost to produce one master disk, but since hundreds of thousands of disks can be produced from one pirated master disk, the cost per pirated disk is low. This has therefore given rise to the problem that as the replica method becomes widespread in the future, it may defeat the effectiveness of piracy prevention techniques at the master disk level.

As described above, the prior art piracy prevention techniques have several problems to be overcome.

These problems are summarized below.

Problem 1: The effectiveness of the master disk level piracy prevention techniques of the prior art is low since it is possible to replicate the physical mark.

Problem 2: In the prior art method that forms a physical mark based on physical mark design data, if a manufacturing apparatus of the same precision as the apparatus used by the legitimate disk manufacturer is obtained, illegal disks can be easily manufactured.

Problem 3: Since the security level provided by the prior art piracy prevention methods is fixed, its effectiveness decreases against constantly improving pirating techniques.

Problem 4: If a disk format without copy protection were allowed to exist along with a disk format with copy protection, pirated disks could be made with the disk format without copy protection. It has therefore been necessary to produce all disks with copy protection. The use of copy protection is therefore limited to closed specifications such as game disks.

Problem 5: According to the prior art methods, a limited number of licensing companies possess the special manufacturing apparatus and do not make the apparatus public. Therefore, software makers cannot make disks except at the licensing companies.

Problem 6: In the master-disk marking method, all disks pressed from the same master disk have the same disk ID. This means that all disks can be run by using

the same password. As a result, password security cannot be maintained unless a floppy disk or a communication line is used in combination. Furthermore, the password has to be entered each time the disk is used since secondary recording is not possible.

SUMMARY OF THE INVENTION

In view of the above-outlined problems of the prior art, it is an object of the present invention to achieve a greatly improved copy prevention capability as compared to the prior art.

More specifically, the present invention provides the following means to overcome the above-outlined six problems of the prior art piracy prevention methods.

To overcome Problem 1, a piracy prevention method involving the use of a physical mark at a reflective film level, rather than the master disk level physical mark as used in the prior art, is provided wherein the physical mark is formed on a reflective film of a disk. This prevents the production of pirated disks if duplication is made at the master disk level.

To overcome Problem 2, a new ROM-recording means is used that performs secondary recording to a two-disk laminated ROM disk by using a laser. In a first step, physical marks are randomly formed, and in a second step, the physical marks are measured with a measuring accuracy as high as 0.13 μm. In a third step, their position information is encrypted and, using the secondary recording means, a barcode is recorded to the ROM disk with an accuracy of several tens of microns which is the usual processing accuracy. Optical mark position information can thus be obtained with an accuracy of, for example, 0.1 μm much higher than the processing accuracy of a conventional apparatus. Since optical marks cannot be formed with the accuracy of 0.1 μm by using commercially available equipment, production of pirated disks can be prevented.

To overcome Problem 3, both a first-generation cipher with a low degree of security and a second-generation cipher with a high degree of security, each enciphering the position information with a digital signature, are prerecorded on a medium and by using such a medium, piracy is prevented with the security corresponding to the applicable generation if the design of reproduction apparatus changes from one generation to the next.

To overcome Problem 4, an anti-piracy function identifier for indicating whether or not the software product is equipped with a copyright anti-piracy function is recorded on the master disk. To prevent the identifier from being altered, compressed information of software contents: and the anti-piracy function identifier are scrambled and encrypted together when recording the software contents on the master disk. Since the identifier cannot be altered, pirates cannot produce disks with a disk format without anti-piracy measures. This prevents the production of pirated disks.

To overcome Problem 5, as a secret key for digital signature encryption indispensable for the manufacture of disks, a subkey is generated from a master key, and the subkey is delivered to each software maker, thereby allowing the software maker to manufacture legitimate disks at its own factory.

To overcome Problem 6, position information of an antipiracy mark of the invention, which differs from one disk to another, is used as a disk identifier. The position information and the disk serial number, i.e., the disk ID, are combined and encrypted together with a digital signature, thus appending an unalterable disk ID to each disk. Since each completed disk has a different ID, the password is also different. The password does not work on other disks. This enhances password security.

Also, with the secondary recording of the invention, the password is secondary-recorded on the disk, permanently making the disk an operable disk.

Specific methods for overcoming the above six problems are disclosed below by way of embodiments.

The invention provides a marking forming apparatus comprising: marking forming means for applying at least one marking to at least one reflective film formed to a disk; marking position detecting means for detecting at least one position of said marking; and position information output means for outputting said detected position as position information of said marking.

The invention also provides a marking forming apparatus further comprising position information writing means for writing at least said output position information or information concerning said position information to said disk or to a different medium.

The invention also provides a method of forming a laser marking to an optical disk, comprising the steps of: forming at least one disk; forming a reflective film to said formed disk; laminating two disks together, said disks including at least one disk with said reflective film formed thereon; and forming at least one marking by a laser on said reflective layer of the laminated disks.

The invention also provides a reproduction apparatus comprising: position information reading means for reading position information of at least one marking or information concerning said position information, said marking being formed to at least one reflective film formed to a disk and being detected for a position thereof, at least the position thus detected being output as said position information of said marking; marking reading means for reading information concerning at least one actual position of said marking; comparing/judging means for performing comparison and judgement by using a result of reading by said position information reading means and a result of reading by said marking reading means; and reproducing means for reproducing recorded data on said optical disk in accordance with a result of the comparison and judgement performed by said comparing/judging means.

The invention also provides a method of manufacturing an optical disk, comprising the steps of: forming at least one disk; forming a reflective film to said formed disk; applying at least one marking to said reflective film; detecting at least one position of said marking; and outputting said detected position as position information of said marking, and encrypting said information for writing to said disk.

The invention also provides a method of manufacturing an optical disk, comprising the steps of: forming at least one disk; forming a reflective film to said formed disk; applying at least one marking to said reflective film;

detecting at least one position of said marking; and outputting said detected position as position information of said marking, and applying a digital signature in relation to said position information for writing to said disk.

The invention also provides an optical disk wherein at least one marking is formed by a laser to at least one reflective film of the disk holding data written thereon and at least position information of said marking or information concerning said position information is written to said disk in an encrypted form or with a digital signature applied thereto.

The invention also provides an optical disk having a structure such that at least one reflective film is sandwiched directly or indirectly between two members formed from material resistant to laser light, wherein at least one marking is formed by a laser to said reflective film.